GP-448-3 (NP-1479)

(6)

PATENT ABSTRACTS OF JAPAN

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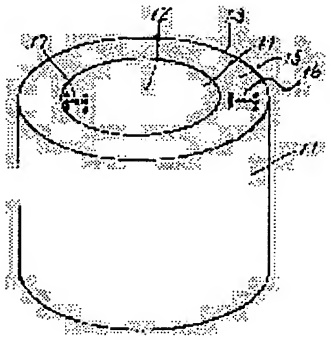
(54) MOLD FOR OPTICAL ELEMENT MOLDING AND ITS PRODUCTION

(57)Abstract:
PURPOSE: To provide the subject mold enabling optical elements to be furnished at low cost by making conventional marking operations needless.
CONSTITUTION: The optically non-functional surface 13 situated on the molding surfaces of a pair of top and bottom molds serving as a mold 11 for optical elements is provided with small recesses 16, 17; the point group at each of the recesses 16, 17 is designed to represent letters, figures or signs and clarify the correlation with optical element. Besides, in cooling operation after molding, shrinkage difference is developed through the parts as nuclei filled in the point group to develop moderate non-point aberration while maintaining the performance of the entire optical element, thus making conventional marking operations needless.



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[Date of extinction of right]	

JAPANESE [JP,06-115955,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS OPERATION EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] The optical element molding die characterized by establishing small heights or a small crevice in the non-optical functional side located in the shaping side of the punch of the pair used as an optical element die, and female mold, and coming to express an alphabetic character, a figure, or a notation by the point group of said heights or a crevice.
[Claim 2] The optical element molding die according to claim 1 characterized by small heights or a small crevice preparing in the ramp of a non-optical functional side.
[Claim 3] The optical element molding die according to claim 1 or 2 characterized by the configuration of small heights or a crevice being a drill-like.
[Claim 4] The manufacture approach of the optical element molding die characterized by to provide the process which forms the mold-release film in the process which grinds an optical functional side and a non-optical functional side in a predetermined configuration and a predetermined mirror plane to the shaping side of the punch of the pair used as an optical element die, and female mold, the process which process heights or a crevice in the shape of a point group on said ground non-optical functional side, and said optical functional side and a non-optical functional side at coincidence.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the optical element molding die used in case the lens used for optical instruments (for example, compact disk etc.) is fabricated, and its manufacture approach.
[0002]
[Description of the Prior Art] In recent years, the attempt which forms an optical lens etc. with one-shot shaping without a polish process is made, and it is already in a mass-production phase in each current company. Although the approach of pouring in and carrying out pressing of the glass material to a mold from a melting condition is the most efficient, it is difficult to control contraction of the glass at the time of cooling, and it is not suitable for precise lens shaping. Therefore, carry out preliminary processing of the glass material at a fixed configuration, and this is supplied between molds, and and what press shaping is carried out for is a general approach (for example, refer to JP,58-8413,A and JP,60-200833,A).
[0003] Drawing 4 is the sectional view of the conventional example showing the condition of having fabricated the cylinder-like glass material and having formed the lens. The lens with which 1 was fabricated, the punch from which 2 and 3 become the die of a pair and female mold, the mold to which 4 surrounds the shaping section by said punch 2 and female mold 3, and 5 and 6 are the hot plates in which heaters 7 and 8 were built. Said punch 2 is attached in the inferior surface of tongue of a hot plate 5, and said female mold 3 is attached in the top face of a hot plate 6. The pressurization device which pressurizes the glass material of a lens 1 in support of the hot plate 5 in which 9 attaches said punch 2 and which can be gone up and down, and 10 are pedestals supported in response to the lower hot plate 6.
[0004] If the actuation in the above-mentioned configuration is explained, a glass material is supplied to the shaping section between said punches 2 and female mold 3, and pressurization deformation will be carried out, heating a glass material to the temperature near the softening temperature of glass between the punch 2 heated by said hot plates 5 and 6, and female mold 3. After completing deformation, if it becomes the temperature which cools the fabricated lens gradually and can take out a lens, a punch 2 will be opened up, a lens is taken out, and shaping is completed.
[0005] The lens obtained with such shaping has very little each aberration (astigmatism, comatic aberration, spherical aberration) which a lens has, and its level is usually high.
[0006]
[Problem(s) to be Solved by the Invention] However, when the number of metal mold sides which the number of mass productions of a shaping lens increase-uses increases, even if the engine performance of a lens item is satisfied, it has the technical problem which some defective generates at a back process (process which assembles a lens to pickup). It must discover promptly whether the lens fabricated with which metal mold is a defective at the back process to this technical problem, and countermeasures must be devised. Moreover, especially in case a shaping lens is built into a device, the directivity of astigmatism must be performed about all the lenses that had marking (it is usually called ASUMAKU) fabricated about each of a lens.
[0007] The reason is that the cross talk (between the pits of the direction of a normal) and intersymbol interference (between the pits of a hoop direction) between pits tend to be mitigated, and it is going to raise the engine performance of a device by arranging correctly the physical relationship of ASUMAKU of a lens, and the signal (pit) formed in the disk front face.
[0008] A great effort is needed to two technical problems mentioned above, a cost cut and mass-production nature of a lens are barred, and it is not desirable on industry. This invention solves such a technical problem, and does unnecessary the activity of ASUMAKU which was being performed conventionally, and it aims at enabling it to offer an optical element cheaply.
[0009]
[Means for Solving the Problem] In order to solve this technical problem, the optical element molding die of this invention establishes small heights or a small crevice in the non-optical functional side located in the shaping side of the punch of the pair used as an optical element die, and female mold, and makes it a summary to come to express an alphabetic character, a figure, or a notation by the point group of said heights or a crevice. Moreover, the manufacture approach of the optical element molding die of this invention The process which grinds an optical functional side and a non-optical functional side in a predetermined configuration and a predetermined mirror plane to the shaping side of the punch of the pair used as an optical element die, and female mold, Let it be a summary to

provide the process which forms the mold release film in the process which processes heights or a crevice on said ground non-optical functional side in the shape of a point group, and said optical functional side and a non-optical functional side at coincidence.

[0010]

[Function] As mentioned above, the part with which clarified correlation with an optical element by the point group of the heights or the crevice established in the non-optical functional side, and the point group of heights or a crevice was filled up is used as a nucleus, by generating moderate astigmatism, the difference of contraction arising and maintaining the engine performance of the whole optical element at the time of cooling, an ASUMA king's activity which was being done conventionally is done unnecessary, and an optical element can be offered cheaply.

[0011]

[Example] Hereafter, one example of this invention is explained based on a drawing. In drawing 1 , what also has the same configuration which dice 11 are the female mold 3 used in said conventional example and this dimension, and was prepared in the shaping side was obtained. The optical functional side 12 shown in the field in [A] drawing which constitutes a shaping side in the end face of the base material which is cylindrical as for this die 11, and consists of cemented carbide, It had the non-optical functional side 13 shown in the field of B, and further, polish processing was performed to a predetermined configuration and a predetermined mirror plane using the diamond wheel so that the non-optical functional side 13 might be equipped with the ramp 14 and the flat-surface section 15 which were extended from the optical functional side 12. Moreover, the shaping side is processed so that the dimension of the field of A is [the dimension of the field of 3.0mm and B] 1.0mm, and a ramp 14 may be set to 0.5mm, and it may set [this die 11 may be 6.0mm in the outer diameter of 5.0mm, and thickness,] the flat-surface section 15 to 0.5mm among the fields of B at a cylinder-like end face and the optical-character ability for which it asks may be obtained. Next, it was processed so that a crevice might exist in the ramp 14 and the flat-surface section 15 of the non-optical functional side 13 in the shape of a point group. Since the processing part was very small and the activity became what used the microscope, in this example, the tip applied the 1g load to the diamond indenter of a square drill using the Vickers hardness meter marketed, and the crevice was processed. The front face was in the mirror plane condition in the square drill of a concave [crevice / which was processed], and the magnitude was 4-5 microns. If the load applied to the configuration of an indenter and an indenter is controlled, it is possible to process the magnitude of arbitration and the crevice of a configuration within limits which have also used what kind of die materials. However, since climax of a material will occur around a crevice if the amount of a crevice is actually large, it is good to lessen the amount of a crevice by the light load desirably. In addition, although the crevice was processed on the shaping side in the shape of a point group in this example, if an alphabetic character, a figure, and a notation can be expressed, as long as it agrees with the main point of not only this example but this invention specially, you may process it by other approaches.

[0012] For example, it is also possible to carry out adhesion processing of the heights in a shaping side at the shape of a point group using a heat-resistant high metallic material with techniques, such as a wire-bonding technique which is looked at by the semi-conductor process, a precise spot welding technique, and plating, etc.

[0013] The condition of drawing 2 having made the crevice 16 of a square drill nine point groups on the conditions mentioned above in the die 11 at said flat-surface section 15, and having drawn the alphabetic character of "I" was shown, and the drawn alphabetic character was the magnitude which can be enough checked under an actual condition microscope. Moreover, as a result of drawing the same alphabetic character also as a ramp 14 on the same conditions, the crevice 17 is similarly formed in the array of an alphabetic character.

[0014] Then, the mold release film which prevents the welding of the glass at the time of shaping to the whole shaping side in which the above-mentioned crevice was established was formed by the spatter. Thickness of membrane formation was made into 2 microns, and it checked under the microscope that membranes were formed by homogeneity also on the front face of said crevice.

[0015] When processing the crevice which shows an alphabetic character, a figure, and a notation with a natural thing, it is good to be easy to read the alphabetic character, figure, or notation imprinted by the shaping lens. Furthermore, in this example, before forming the mold release film, crevice processing was performed, but the same effectiveness is expectable even if it carries out after membrane formation.

[0016] Drawing 3 shows the shaping lens fabricated and obtained at 520 degrees C like the conventional example using the glass material for shaping which serves as shaping metal mold of the example mentioned above from SF-8 (lead system glass). Heights 19 and 20 are formed in the shaping lens 18 of said crevices 16 and 17. Although what the imprint nature in the crevice 17 established in said ramp 14 satisfies about all the shaping lenses was obtained as a result of performing the check of the imprint nature of the crevice part in a shaping lens 18, and the check of optical-character ability, the non-imprinted section generated in the part the imprint nature in the crevice 16 established in the flat-surface section 15. The reason is generated from weight fluctuation of the glass ingredient of an amount, and fluctuation of an imprint field a little. Therefore, it is desirable to establish a crevice 17 in the ramp 14 of a non-optical functional side. It is because it is hard to use the flat surface out of which used the flat-surface section 15 of the fabricated lens as a datum clamp face to a device besides the above [the reason] in many cases, and the projection came as datum level.

[0017] Furthermore, the transmitted wave side aberration of a shaping lens was measured using the interferometer of a FIZO mold. Consequently, it was checked that the imprint of the crevice 16 established in the flat-surface section 15 does not have effect in the engine performance of the whole lens in any way. However, the imprint of the crevice 17 established in the ramp 14 was set into the other part near the pole of a crevice with regards to the

astigmatism of a lens, and the difference of the surface sink at the time of contraction was checked. And the engine performance of the whole lens was a ****** thing enough in 0.03lambda extent at practical use.

[0018]

[Effect of the Invention] An ASUMA king's activity which was being conventionally done as mentioned above by generating moderate astigmatism, the difference of contraction arising and maintaining [use as a nucleus the part with which clarified correlation with an optical element by the point group of the heights or the crevice established in the non-optical functional side, and the point group of heights or a crevice was filled up, and] the engine performance of the whole optical element at the time of cooling according to this invention is done unnecessary, and an optical element can be offered cheaply.

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] This invention relates to the optical element molding die used in case the lens used for optical instruments (for example, compact disk etc.) is fabricated, and its manufacture approach.

[Translation done.]

PRIOR ART

[Description of the Prior Art] In recent years, the attempt which forms an optical lens etc. with one-shot shaping without a polish process is made, and it is already in a mass-production phase in each current company. Although the approach of pouring in and carrying out pressing of the glass material to a mold from a melting condition is the most efficient, it is difficult to control contraction of the glass at the time of cooling, and it is not suitable for precise lens shaping. Therefore, carry out preliminary processing of the glass material at a fixed configuration, and this is supplied between molds, and and what press shaping is carried out for is a general approach (for example, refer to JP,58-8413,A and JP,60-200833,A).

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[0004] If the actuation in the above-mentioned configuration is explained, a glass material is supplied to the shaping section between said punches 2 and female mold 3, and pressurization deformation will be carried out, heating a glass material to the temperature near the softening temperature of glass between the punch 2 heated by said hot plates 5 and 6, and female mold 3. After completing deformation, if it becomes the temperature which cools the fabricated lens gradually and can take out a lens, a punch 2 will be opened up, a lens is taken out, and shaping is completed.

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EFFECT OF THE INVENTION

[Effect of the Invention] An ASUMA king's activity which was being conventionally done as mentioned above by generating moderate astigmatism, the difference of contraction arising and maintaining [use as a nucleus the part with which clarified correlation with an optical element by the point group of the heights or the crevice established in the non-optical functional side, and the point group of heights or a crevice was filled up, and] the engine performance of the whole optical element at the time of cooling according to this invention is done unnecessary, and an optical element can be offered cheaply.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, when the number of metal mold sides which the number of mass productions of a shaping lens increase-uses increases, even if the engine performance of a lens item is satisfied, it has the technical problem which some defective generates at a back process (process which assembles a lens to pickup). It must discover promptly whether the lens fabricated with which metal mold is a defective at the back process to this technical problem, and countermeasures must be devised. Moreover, especially in case a shaping lens is built into a device, the directivity of astigmatism must be performed about all the lenses that had marking (it is usually called ASUMAKU) fabricated about each of a lens.
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[Translation done.]

MEANS

[Means for Solving the Problem] In order to solve this technical problem, the optical element molding die of this invention establishes small heights or a small crevice in the non-optical functional side located in the shaping side of the punch of the pair used as an optical element die, and female mold, and makes it a summary to come to express an alphabetic character, a figure, or a notation by the point group of said heights or a crevice. Moreover, the manufacture approach of the optical element molding die of this invention The process which grinds an optical functional side and a non-optical functional side in a predetermined configuration and a predetermined mirror plane to the shaping side of the punch of the pair used as an optical element die, and female mold, Let it be a summary to provide the process which forms the mold release film in the process which processes heights or a crevice on said ground non-optical functional side in the shape of a point group, and said optical functional side and a non-optical functional side at coincidence.

[Translation done.]

OPERATION

[Function] As mentioned above, the part with which clarified correlation with an optical element by the point group of the heights or the crevice established in the non-optical functional side, and the point group of heights or a crevice was filled up is used as a nucleus, by generating moderate astigmatism, the difference of contraction arising and maintaining the engine performance of the whole optical element at the time of cooling, an ASUMA king's activity which was being done conventionally is done unnecessary, and an optical element can be offered cheaply.

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EXAMPLE

[Example] Hereafter, one example of this invention is explained based on a drawing. In drawing 1 , what also has the same configuration which dice 11 are the female mold 3 used in said conventional example and this dimension, and was prepared in the shaping side was obtained. The optical functional side 12 shown in the field in [A] drawing which constitutes a shaping side in the end face of the base material which is cylindrical as for this die 11, and consists of cemented carbide, It had the non-optical functional side 13 shown in the field of B, and further, polish processing was performed to a predetermined configuration and a predetermined mirror plane using the diamond wheel so that the non-optical functional side 13 might be equipped with the ramp 14 and the flat-surface section 15 which were extended from the optical functional side 12. Moreover, the shaping side is processed so that the dimension of the field of A is [the dimension of the field of 3.0mm and B] 1.0mm, and a ramp 14 may be set to 0.5mm, and it may set [this die 11 may be 6.0mm in the outer diameter of 5.0mm, and thickness,] the flat-surface section 15 to 0.5mm among the fields of B at a cylinder-like end face and the optical-character ability for which it asks may be obtained. Next, it was processed so that a crevice might exist in the ramp 14 and the flat-surface section 15 of the non-optical functional side 13 in the shape of a point group. Since the processing part was very small and the activity became what used the microscope, in this example, the tip applied the 1g load to the diamond indenter of a square drill using the Vickers hardness meter marketed, and the crevice was processed. The front face was in the mirror plane condition in the square drill of a concave [crevice / which was processed], and the magnitude was 4-5 microns. If the load applied to the configuration of an indenter and an indenter is controlled, it is possible to process the magnitude of arbitration and the crevice of a configuration within limits which have also used what kind of die materials. However, since climax of a material will occur around a crevice if the amount of a crevice is actually large, it is good to lessen the amount of a crevice by the light load desirably. In addition, although the crevice was processed on the shaping side in the shape of a point group in this example, if an alphabetic character, a figure, and a notation can be expressed, as long as it agrees with the main point of not only this example but this invention specially, you may process it by other approaches.

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section 15 does not have effect in the engine performance of the whole lens in any way. However, the imprint of the crevice 17 established in the ramp 14 was set into the other part near the pole of a crevice with regards to the astigmatism of a lens, and the difference of the surface sink at the time of contraction was checked. And the engine performance of the whole lens was a ****** thing enough in 0.03lambda extent at practical use.

[Translation done.]

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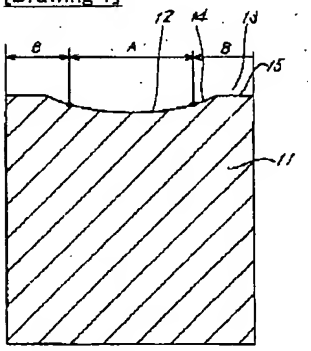
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view of the optical element die in one example of this invention.
[Drawing 2] It is the perspective view of this optical element die.
[Drawing 3] It is the perspective view of the shaping lens fabricated using this optical element die.
[Drawing 4] It is drawing of longitudinal section showing the shaping condition in the conventional example.
[Description of Notations]
11 Die
12 Optical Functional Side
13 Non-Optical Functional Side
14 Ramp
15 Flat-Surface Section
16 Crevice
17 Crevice
18 Shaping Lens
19 Heights
20 Heights

[Translation done.]

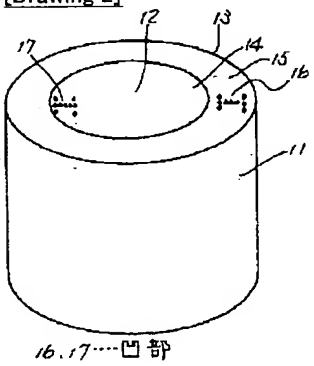
DRAWINGS

[Drawing 1]



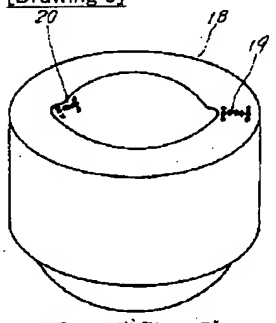
11…成形型
12…光学機能面
13…非光学機能面
14…傾斜部
15…平面部

[Drawing 2]



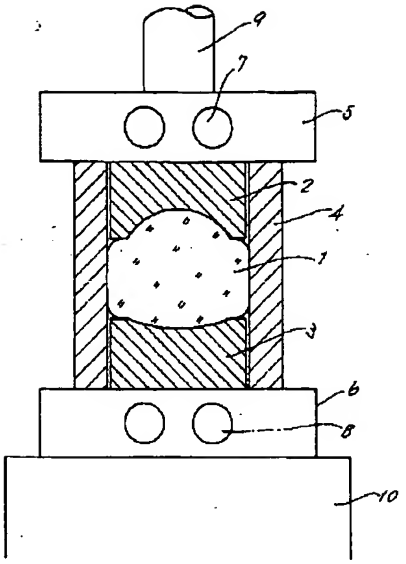
16、17…凹部

[Drawing 3]



18……成形レンズ
19、20…凸部

[Drawing 4]



[Translation done.]

GP-448-3 (NP-1479) (6)

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特開平6－115955

(43)公開日　平成６年(1994)４月26日

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Ｃ０３Ｂ　11/08				

審査請求　未請求　請求項の数４(全　４　頁)

(21)出願番号　特願平4－266940

(22)出願日　平成４年(1992)10月６日

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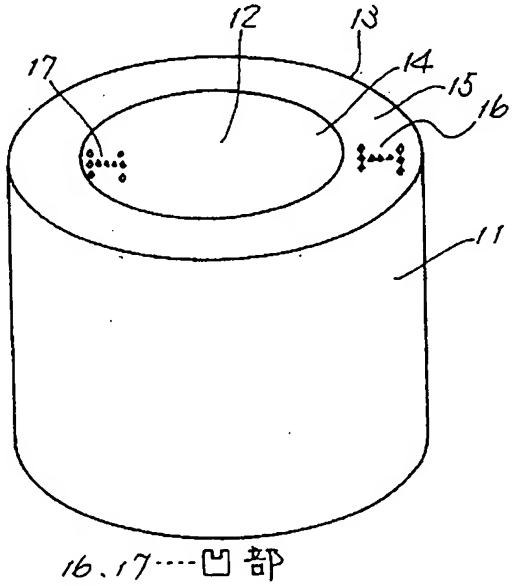
(74)代理人　弁理士　森本　義弘

(54)【発明の名称】　光学素子成形用金型およびその製造方法

(57)【要約】

【目的】従来行なっていたアスマークの作業を不要にし、光学素子を安価に提供できるようにすることを目的とする。

【構成】光学素子成形型11となる一対の上型、下型の成形面に位置する非光学機能面13に小さな凹部16，17を設け、前記凹部16，17の点群で文字または数字または記号を表現してなり、非光学機能面13に設けた凹部16，17の点群によって光学素子との相関を明確にし、また凹部16，17の点群に充填された部分を核にして冷却時に収縮の差が生じ、光学素子全体の性能を維持しつつ適度な非点収差を発生させることで、従来行なっていたアスマーキングの作業を不要にした。

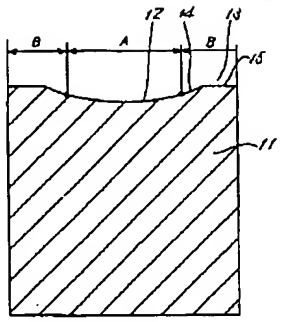


【特許請求の範囲】
【請求項１】　光学素子成形型となる一対の上型、下型の成形面に位置する非光学機能面に小さな凸部または凹部を設け、前記凸部または凹部の点群で文字または数字または記号を表現してなることを特徴とする光学素子成形用金型。
【請求項２】　小さな凸部または凹部が非光学機能面の傾斜部に設けたことを特徴とする請求項１記載の光学素子成形用金型。
【請求項３】　小さな凸部または凹部の形状が錐状であることを特徴とする請求項１または２記載の光学素子成形用金型。
【請求項４】　光学素子成形型となる一対の上型、下型の成形面に光学機能面および非光学機能面を所定の形状と鏡面に研磨する工程と、前記研磨された非光学機能面に凸部または凹部を点群状に加工する工程と、前記光学機能面と非光学機能面とに離型膜を同時に形成する工程とを具備することを特徴とする光学素子成形用金型の製造方法。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は光学機器（例えば、コンパクトディスクなど）に使用されるレンズなどを成形する際に用いられる光学素子成形用金型およびその製造方法に関するものである。
【０００２】
【従来の技術】近年、光学レンズなどを研磨工程なしの一発成形により形成する試みがなされており、現在各社ではすでに量産段階にある。ガラス素材を溶融状態から型に流しこみ加圧成形する方法が最も能率的であるが、冷却時のガラスの収縮を制御することが難しく、精密なレンズ成形には適さない。従ってガラス素材を一定の形状に予備加工して、これを型の間に供給し、加熱、押圧成形するのが一般的な方法である（例えば、特開昭５８－８４１３号公報、特開昭６０－２００８３３号公報参照）。
【０００３】図４は円柱状のガラス素材を成形してレンズを形成した状態を示す従来例の断面図であり、１は成形されたレンズ、２および３は一対の成形型となる上型および下型、４は前記上型２および下型３による成形部を取り巻く胴型、５および６はヒータ７および８が内蔵された加熱板で、加熱板５の下面に前記上型２が取り付けられ、加熱板６の上面に前記下型３が取り付けられている。９は前記上型２を取り付ける加熱板５を支持してレンズ１のガラス素材を加圧する昇降自在な加圧機構、10は下側の加熱板６を受けて支持する基台である。
【０００４】上記構成における動作を説明すると、ガラス素材を前記上型２および下型３との間の成形部に供給し、前記加熱板５および６で加熱された上型２および下型３間でガラス素材をガラスの軟化点近傍の温度まで加熱しながら加圧変形させる。変形が終了後は成形されたレンズを徐々に冷却してレンズが取り出せる温度になると上型２を上方に開き、レンズを取り出し成形を完了する。
【０００５】このような成形で得られたレンズは通常、レンズが有する各収差（非点収差、コマ収差、球面収差）などが非常に少なく、レベルの高いものである。
【０００６】
【発明が解決しようとする課題】しかし、成形レンズの量産数が増し使用する金型面数が多くなると、レンズ単品の性能は満足されても後工程（レンズをピックアップに組み立てる工程）で若干の不良品が発生する課題がある。この課題に対し、どの金型で成形されたレンズが後工程で不良品になっているかをいち早く発見し対応策を講じなければならない。また、成形レンズを機器に組み込む際には、特に非点収差の方向性をレンズの各々についてマーキング（通常アスマークと呼ぶ）を成形された全てのレンズについて行なわなければならない。
【０００７】その理由は、レンズのアスマークとディスク表面に形成された信号（ピット）との位置関係を正確に配置することによってピット間のクロストーク（法線方向のピット間）や符号間干渉（周方向のピット間）を軽減し、機器の性能を高めようとするからである。
【０００８】上述した２つの課題に対しては多大の労力を必要とし、レンズのコストダウンと量産性を妨げ、産業上好ましくない。本発明はこのような課題を解決するもので、従来行なっていたアスマークの作業を不要にし、光学素子を安価に提供できるようにすることを目的とするものである。
【０００９】
【課題を解決するための手段】この課題を解決するために本発明の光学素子成形用金型は、光学素子成形型となる一対の上型、下型の成形面に位置する非光学機能面に小さな凸部または凹部を設け、前記凸部または凹部の点群で文字または数字または記号を表現してなることを要旨とするものである。また本発明の光学素子成形用金型の製造方法は、光学素子成形型となる一対の上型、下型の成形面に光学機能面および非光学機能面を所定の形状と鏡面に研磨する工程と、前記研磨された非光学機能面に凸部または凹部を点群状に加工する工程と、前記光学機能面と非光学機能面とに離型膜を同時に形成する工程とを具備することを要旨とするものである。
【００１０】
【作用】上記のように、非光学機能面に設けた凸部または凹部の点群によって光学素子との相関を明確にし、また凸部または凹部の点群に充填された部分を核にして冷却時に収縮の差が生じ、光学素子全体の性能を維持しつつ適度な非点収差を発生させることで、従来行なっていたアスマーキングの作業を不要にし、光学素子を安価に提供できる。

【００１１】
【実施例】以下、本発明の一実施例について、図面に基づいて説明する。図１において、成形型11は前記従来例で用いた下型３と同寸法で、成形面に設けられた形状も同様のものが得られるようにした。この成形型11は、円柱状で超硬合金からなる基材の端面に成形面を構成する図中Ａの領域で示される光学機能面12と、Ｂの領域で示される非光学機能面13とを備え、さらに、非光学機能面13は光学機能面12から延長された傾斜部14と平面部15とを備えるように、ダイヤモンド砥石を用いて所定の形状と鏡面に研磨加工が施された。また、この成形型11は外径５．０mm、厚み６．０mmで、円柱状の端面にＡの領域の寸法が３．０mm、Ｂの領域の寸法が１．０mmで、Ｂの領域のうち傾斜部14を０．５mm、平面部15を０．５mmとし、かつ所望する光学性能が得られるように成形面が加工されている。次に、非光学機能面13の傾斜部14と平面部15とに凹部が点群状に存在するように加工を行なった。加工箇所が非常に小さいため作業は顕微鏡を用いたものとなるので、本実施例では市販されているビッカース硬度計を用い先端が四角錐のダイヤモンド圧子に１グラムの荷重をかけて凹部の加工を行なった。加工された凹部は凹状の四角錐でその表面は鏡面状態であり、その大きさは４～５ミクロンであった。圧子の形状および圧子にかける荷重を制御すればどのような型材料を用いてもある範囲内で任意の大きさと形状の凹部を加工することが可能である。しかし、現実的には凹部の量が大きいと凹部周辺に素材の盛り上がりが発生するため、望ましくは軽荷重で凹部の量を少なくするのがよい。なお、本実施例では成形面に凹部を点群状に加工したが、別段、文字、数字、記号を表現できれば本実施例に限らず本発明の主旨に合致するものであれば他の方法で加工してもよい。
【００１２】例えば、半導体プロセスに見られるようなワイヤーボンディング技術や、精密なスポット溶接技術、メッキなどの技術などにより、耐熱性の高い金属材料を用いて成形面に凸部を点群状に付着加工することも可能である。
【００１３】図２は成形型11に前述した条件で前記平面部15に四角錐の凹部16を９個の点群にして「Ｉ」の文字を描いた状態を示し、描かれた文字は実態顕微鏡で充分確認できる大きさであった。また、傾斜部14にも同様の文字を同様の条件で描いた結果、同様に文字の配列に凹部17が形成されている。
【００１４】その後、上記凹部を設けた成形面全体に成形時におけるガラスの融着を防止する離型膜をスパッタ法で成膜した。成膜の厚みは２ミクロンとし、前記凹部の表面にも均一に成膜されていることを顕微鏡で確認した。
【００１５】当然のことながら文字、数字、記号を示す凹部の加工を行なう場合には、成形レンズに転写された文字、数字あるいは記号が読み取り易いようにするのがよい。さらに、本実施例では離型膜を成膜する前に凹部加工を行なったが、成膜後に行なっても同様の効果が期待できるものである。
【００１６】図３は前述した実施例の成形金型と、ＳＦ－８（鉛系ガラス）からなる成形用ガラス素材を用いて従来例と同様にして５２０℃で成形を行なって得られた成形レンズを示す。成形レンズ18には前記凹部16，17により凸部19，20が形成されている。成形レンズ18における凹部部分の転写性の確認と、光学性能の確認とを行なった結果、前記傾斜部14に設けた凹部17での転写性は成形レンズの全てについて満足するものが得られたが、平面部15に設けた凹部16での転写性は一部分に未転写部が発生した。その理由は若干量のガラス材料の重量変動や、転写領域の変動から発生するものである。従って、非光学機能面の傾斜部14に凹部17を設けるのが望ましい。その理由は上記の他に、成形されたレンズの平面部15は機器への取付基準面として使用することが多く、突起の出た平面を基準面として使いづらいからである。
【００１７】さらに、フィーゾ型の干渉計を用いて成形レンズの透過波面収差を測定した。その結果、平面部15に設けた凹部16の転写はレンズ全体の性能には何ら影響の無いことが確認された。しかし、傾斜部14に設けた凹部17の転写はレンズの非点収差に関係し、凹部の極近傍とそれ以外の部分とにおいて収縮時におけるひけの差が確認された。しかも、レンズ全体の性能は０．０３λ程度で充分実用に供せるものであった。
【００１８】
【発明の効果】以上のように本発明によれば、非光学機能面に設けた凸部または凹部の点群によって光学素子との相関を明確にし、また凸部または凹部の点群に充填された部分を核にして冷却時に収縮の差が生じ、光学素子全体の性能を維持しつつ適度な非点収差を発生させることで、従来行なっていたアスマーキングの作業を不要にし、光学素子を安価に提供できる。
【図面の簡単な説明】
【図１】本発明の一実施例における光学素子成形型の断面図である。
【図２】同光学素子成形型の斜視図である。
【図３】同光学素子成形型を用いて成形された成形レンズの斜視図である。
【図４】従来例における成形状態を示す縦断面図である。
【符号の説明】
11　成形型
12　光学機能面
13　非光学機能面
14　傾斜部
15　平面部
16　凹部

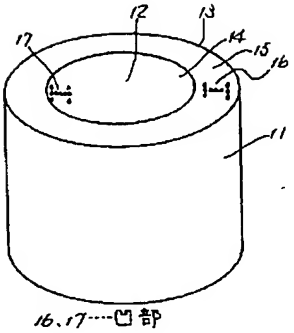
17　凹部
18　成形レンズ
19　凸部
20　凸部

【図１】



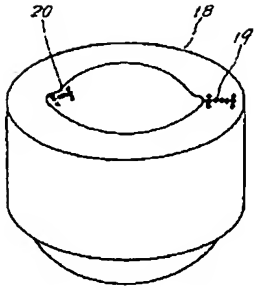
11……成形型
12……光学機能面
13……非光学機能面
14……傾斜部
15……平面部

【図２】



16、17……凹部

【図３】



18……成形レンズ
19、20……凸部

【図４】